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Imaging

DECOMPOSITION OF E-WAVE DECELERATION TIME INTO STIFFNESS AND RELAXATION COMPONENTS

Poster Contributions
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Background: The short deceleration time (DT) (“constrictive-restrictive”) E-wave pattern is due to increased chamber stiffness, while prolonged E-wave deceleration time is due to ‘delayed relaxation’. Therefore, stiffness and relaxation are DT determinants. DT has been expressed algebraically as a function of stiffness only. Subsequent analysis of E-waves via the parametrized diastolic filling (PDF) formalism revealed that DT is an algebraic function of both stiffness and relaxation.

Method: We hypothesize that E-wave analysis via PDF permits decomposition of DT into stiffness (DTs) and relaxation (DTr) components (DT = DTs + DTr), reflecting diastatic chamber stiffness (K, slope of diastatic pressure-volume relation), and relaxation ($\rightarrow$isovolumic time-constant) effects. For validation, simultaneous (conductance catheter) pressure-volume (P-V) and E-wave data from 12 control subjects, normal (>50%) LV ejection fraction, and 4 with delayed relaxation (DT>220 msec) were analyzed. PDF analysis of each E-wave provided DTs and DTr.

Results: For all 16 subjects (27 beats/subject, 430 beats total) linear regression yielded DTs = α K + β (R2 = 0.72) where α = -0.37 and β = 0.19, and DTr = m τ + b (R2 = 0.89) where m = 2.49 and b = -0.10.

Conclusion: E-wave DT consists of stiffness (DTs) and relaxation (DTr) components that are determined by diastatic chamber stiffness (K) and relaxation (τ) respectively.